

SUBCHAPTER C : GENERAL STANDARDS AND METHODS
Effective April 28, 1997
§§331.41-331.48

§331.41. Applicability.

The provisions of this subchapter set forth standards and requirements that apply to all Class I and Class III wells, unless specifically excluded.

§331.42. Area of Review.

(a) The area of review is the area surrounding an injection well or a group of injection wells, for which the permit application must detail the information required in Subchapter G of this title (relating to Consideration Prior to Permit Issuance).

(b) The area of review is:

(1) for Class I wells, an area determined by a radius of 2 1/2 miles from the proposed or existing wellbore, or the area within the cone of influence, whichever is greater;

(2) for salt cavern disposal wells and associated caverns, the sum of the two following areas:

(A) an area determined by a radius of 2 1/2 miles from the proposed or existing wellbore; and

(B) the greatest horizontal plane cross sectional area of the salt dome between land surface and a depth of 1,000 feet below the projected floor of the proposed or existing salt cavern;

(3) for Class III wells, the project area plus a circumscribing area, a minimum of 1/4 mile, the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into a USDW; or

(4) for Class V wells, an area determined by a radius of at least 1/4 mile from the proposed or existing wellbore.

(c) The computation of the cone of influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. The following modified Theis equation illustrates one form which the mathematical model may take.

$$r = (2.25 KHht / S10^*)^{1/2}$$

Where

$$x = 4\pi KH (h_w - h_{bo} \times S_p G_b) / 2.3 Q$$

r = radius of endangering influence from injection well (length)

K = hydraulic conductivity of the injection zone (length/time)

H = thickness of the injection zone (length)

t = time of injection (time)

S = storage coefficient (dimensionless)

Q = injection rate (volume/time)

h_{bo} = observed original hydrostatic head of injection zone (length) measured from the base of the lowermost underground source of drinking water

h_w = hydrostatic head of underground source of drinking water (length) measured from the base of the lowest underground source of drinking water

$S_p G_b$ = specific gravity of fluid in the injection zone (dimensionless)

$\pi = 3.142$ (dimensionless)

The above equation is based on the following assumptions:

- (1) the injection zone is homogenous and isotropic;
- (2) the injection zone has infinite area extent;
- (3) the injection well penetrates the entire thickness of the injection zone;
- (4) the well diameter is infinitesimal compared to "r" when injection time is longer than a few minutes; and
- (5) the emplacement of fluid into the injection zone creates instantaneous increase in pressure.

(d) After an appropriate review, the commission may modify the area of review. In no event shall the boundary of an area of review be less than 2 1/2 miles for Class I wells or 1/4 mile from any other injection well covered by the appropriate authorization. The following factors are to be included in the review:

- (1) Chemistry of injection and formation fluids;
- (2) Hydrogeology;
- (3) Population and its dependence on ground water use; and
- (4) Historical practices in the area.

(e) The executive director may require an owner or operator of an existing injection well to submit any reasonably available information regarding the area of review, if the information would aid a review for the prevention or correction of freshwater pollution.

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§331.43. Mechanical Integrity Standards.

- (a) An injection well has mechanical integrity if:
 - (1) there is no significant leak in the casing, tubing, or packer, and
 - (2) if there is no significant fluid movement through vertical channels adjacent to the injection wellbore.
- (b) A salt cavern has integrity if it:
 - (1) has no anomalies or irregularities that would prevent optimum cavern filling or that would prevent the cavern from holding pressure; and
 - (2) has no pressure communication or fluid flow between other caverns or formations outside the salt stock. The tests to show salt cavern integrity shall consist of cavern pressure and sonar tests, or other tests approved by the executive director, to determine the geometric shape of the unfilled cavern.
- (c) Methods and standards approved by the EPA through federal Underground Injection Control Program delegation to the commission, shall be applied in conducting and evaluating the tests required by this section.
- (d) When the owner or operator reports the results of mechanical integrity tests to the executive director, he shall include a description of the test(s) and the method(s) used. In making his/her evaluation, the executive director shall review monitoring and other test data submitted since the previous evaluation.
- (e) The executive director may require additional or alternative tests if the results presented by the owner or operator under subsection (d) of this section are not satisfactory to the executive director to demonstrate that there is no movement of fluid into or between USDWs resulting from the injection activity.

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§331.44. Corrective Action Standards.

- (a) Corrective action standards for all wells. In determining the adequacy of corrective action proposed or required to prevent or correct pollution of underground sources of drinking waters (USDWs), and fresh or surface water, the following factors shall be considered:
 - (1) toxicity and volume of the injected fluid;
 - (2) toxicity of native fluids and by-products of injection;
 - (3) population potentially affected;
 - (4) geology and hydrology;
 - (5) history of the injection operation;

- (6) completion and plugging records;
- (7) abandonment procedures in effect at the time a well was abandoned;
- (8) hydraulic connections with USDWs, and fresh or surface water;
- (9) Reliability of the procedures used to identify abandoned wells;
- (10) Any other factors which might affect the movement of fluids into or between USDWs;

and

(11) For Class III wells only, when setting corrective action requirements the executive director shall consider the overall effect of the project on the hydraulic gradient in potentially affected USDWs, and the corresponding changes in potentiometric surfaces(s) and flow directions(s) rather than the discrete effect of each well. If a decision is made that corrective action is not necessary based on the determinations in this paragraph, the monitoring program required in §331.84 of this title (relating to Monitoring Requirements) shall be designed to verify the validity of those determinations.

(b) Additional Corrective action standards for Class I wells.

(1) For such wells within the area of review which are in the opinion of the executive director inadequately constructed, completed, plugged, or abandoned, or for which plugging or completion information is unavailable, the applicant shall also submit a plan consisting of such steps or modifications as are necessary to prevent movement of fluids into or between USDWs or freshwater aquifers. Where such a plan is adequate, the commission shall incorporate it into the permit as a condition. Where the executive director's review of an application indicates that the permittee's plan is inadequate the executive director shall:

- (A) require the applicant to revise the plan;
- (B) prescribe a plan for corrective action as a condition of the permit; or
- (C) deny the application.

(2) The criteria of §331.44(a) of this title (relating to Corrective Action Standards) will be used to determine adequacy.

(3) Any permit issued for a Class I well which was authorized prior to August 25, 1988 by an approved state program or an EPA-administered program or a well which has become a Class I well as a result of a change in the definition of the injected waste which would render the waste hazardous under §331.2 of this title (relating to Definitions) and which require corrective action other than pressure limitations shall include a compliance schedule requiring any corrective action accepted or prescribed under this section. Any such compliance schedule shall provide for compliance no later than 2 years following issuance of the permit and shall require observance of appropriate pressure limitations under paragraph (b)(4) until all other corrective action measures have been implemented.

(4) As part of the corrective action plan, the commission may impose an injection pressure limitation that does not cause the pressure in the injection zone to be sufficient to drive fluids into or between

USDWs or freshwater aquifers in those wells described in subsection (a) of this section, which condition shall expire upon adequate completion of all corrective action measures.

(5) Action prescribed by a corrective action plan for new wells or new areas must be completed to the satisfaction of the executive director before operation of the well begins.

(6) In the event that, after an authorization for injection has been granted, additional information is submitted or discovered that a well within the applicable area of review might pose a hazard to a USDW or freshwater aquifer, the commission may prescribe a corrective action plan and compliance schedule as a condition for continued injection activities.

(7) If at any time the operator cannot assure the continuous attainment of the performance standard in §331.62(5) of this title (relating to Construction Standards), the executive director may require a corrective action plan and compliance schedule. The operator must demonstrate compliance with the performance standard, as a condition for receiving approval of continued operation of the well. The executive director also may require permit changes to provide for additional testing and/or monitoring of the well to insure the continuous attainment of the performance standard. The commission may order closure of the well if the operator fails to demonstrate, to the executive directors satisfaction, that the performance standard is satisfied.

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§331.45 Executive Director Approval of Construction and Completion.

The executive director may approve or disapprove the construction and completion for an injection well or project. In making a determination whether to grant approval, the following shall be reviewed for compliance with the standards of this chapter:

(1) for Class I wells, other than salt cavern disposal wells and associated salt caverns:

(A) actual as-built drilling and completion data on the well;

(B) all logging and testing data on the well;

(C) a demonstration of mechanical integrity;

(D) anticipated maximum pressure and flow rate at which the permittee will operate;

(E) results of the injection zone and confining zone testing program as required in §331.62(7) of this title (relating to Construction Standards) and §331.65(a) of this title (relating to Pre-operation Reports);

(F) the actual injection procedure;

(G) the compatibility of injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone and materials used to construct the well;

(H) the calculated area of review and cone of influence based on data obtained during logging and testing of the well and the formation, and where necessary, revisions to the information submitted under §331.121 of this title (relating to Class I Wells);

(I) the status of corrective action required for defective wells in the area of review;

(J) compliance with the casing and cementing performance standard in §331.62(5) of this title, and where necessary, changes to the permit to provide for additional testing and/or monitoring of the well to insure the continuous attainment of the performance standard; and

(K) compliance with the cementing requirements in §331.62(6).

(2) for salt cavern disposal wells and associated salt caverns:

(A) actual as-built drilling and completion data on the well;

(B) all logging, coring, and testing program data on the well and salt pilot hole;

(C) a demonstration of mechanical integrity of the well;

(D) the anticipated maximum wellhead and casing seat pressures and flow rates at which the well will operate during cavern development and cavern waste filling;

(E) results of the salt cavern injection zone and salt cavern confining zone testing program as required in §331.163(e)(3) of this title (relating to salt cavern solid waste disposal wells).

(F) the injection and production procedures for cavern development and cavern waste filling;

(G) the compatibility of injected materials with the contents of the salt cavern injection zone and the salt cavern confining zone, and with the materials of well construction;

(H) land subsidence monitoring data and groundwater quality monitoring data, including determinations of baseline conditions for such monitoring throughout the area of review;

(I) the status of corrective action required for defective wells in the area of review;

(J) actual as-built specifications of the well's surface support and monitoring equipment; and

(K) conformity of the constructed well system with the plans and specifications of the permit application.

(3) for Class III wells:

(A) logging and testing data on the well;

(B) a satisfactory demonstration of mechanical integrity for all new wells, excluding monitor wells;

(C) anticipated operating data;

(D) the results of the formation testing program;

(E) the injection procedures; and

(F) the status of corrective action required for defective wells in the area of review.

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§331.46. Closure Standards.

(a) For Class I wells, other than salt cavern disposal wells, prior to closing the well, the owner or operator shall observe and record the pressure decay for a time specified by the executive director. The executive director shall analyze the pressure decay and the transient pressure observations conducted pursuant to §331.64 of this title (relating to Class I Wells) and determine whether the injection activity has conformed with predicted values.

(b) For all Class I wells, including salt cavern disposal wells, prior to well closure appropriate mechanical integrity testing shall be conducted to ensure the integrity of that portion of the long string casing and cement that will be left in the ground after closure. Testing methods may include:

(1) Pressure tests with liquid or gas;

(2) Radioactive tracer surveys for wells other than saltcavern disposal wells;

(3) Noise logs, temperature logs, pipe evaluation logs, cement bond logs, or oxygen activation logs; and

(4) Any other test required by the executive director.

(c) For Class I wells, other than salt cavern disposal wells, prior to well closure the well shall be flushed with a non-hazardous buffer fluid.

(d) In closure of all Class I wells, including salt cavern disposal wells, Class III wells, and permitted Class V wells, a well shall be plugged in a manner which will not allow the movement of fluids through the well, out of the injection zone either into or between underground sources of drinking waters (USDWs) or to the land surface. Well plugs shall consist of cement or other materials approved in writing by the executive director, which provide protection equivalent to or greater than that provided by cement.

(e) The permittee shall notify the executive director before commencing closure according to an approved plan. For Class I wells this notice shall be given at least 60 days before commencement. At the discretion of the executive director, a shorter notice period may be allowed. The executive director shall review any revised, updated, or additional closure plans.

(f) Placement of the plugs in the wellbore shall be accomplished by an approved method that may include one of the following:

- (1) the Balance Plug Method;
- (2) the Dump Bailer Method;
- (3) the Two-Plug Method; or

(4) an alternate method, approved by the executive director, that will reliably provide a comparable level of protection.

(g) Prior to closure, the well shall be in a state of static equilibrium with the mud or nonhazardous fluid weight equalized top to bottom, either by circulating the mud or fluid in the well at least once or by a comparable method prescribed by the executive director.

(h) Each plug used shall be appropriately tagged and tested for seal and stability before closure is completed.

(i) The closure plan shall, in the case of a Class III production zone which underlies or is in an exempted aquifer, also demonstrate that no movement of contaminants that will cause pollution from the production zone into a USDW or freshwater aquifer will occur. The commission shall prescribe aquifer cleanup and monitoring where deemed necessary and feasible to ensure that no migration of contaminants that will cause pollution from the production zone into a USDW or freshwater aquifer will occur.

(j) The following shall be considered in determining the adequacy of a plugging and abandonment plan for Class I and III wells:

- (1) the type and number of plugs to be used;
- (2) the placement of each plug including the elevation of the top and bottom;
- (3) the type, grade and quantity of plugging material to be used;
- (4) the method of placement of the plugs;
- (5) the procedure used to plug and abandon the well;

(6) any newly constructed or discovered wells, or information, including existing well data, within the area of review;

- (7) geologic or economic conditions;
- (8) the amount, size and location by depth of casings and any other materials left in the well;
- (9) the method and location where casing is to be parted if applicable;
- (10) the estimated cost of the plugging procedure; and,

(11) such other factors that may affect the adequacy of the plan.

(k) For Class I wells only, a monument or other permanent marker shall be placed at or attached to the plugged well before abandonment. The monument shall state the permit number, date of abandonment, and company name.

(l) Each owner of a Class I hazardous waste injection well, and the owner of the surface or subsurface property on or in which a Class I hazardous waste injection well is located, must record, within 60 days after approval by the executive director of the closure operations, a notation on the deed to the facility property or on some other instrument which is normally examined during a title search that will, in perpetuity, provide any potential purchaser of the property the following information:

(1) the fact that land has been used to manage hazardous waste;

(2) the name of the state agency or local authority with which the plat was filed, as well as the Austin address of the Underground Injection Control (UIC) staff of the commission, to which it was submitted; and

(3) the type and volume of waste injected, the injection interval or intervals, and for salt cavern wells, the maximum cavern radius into which it was injected, and the period over which injection occurred.

(m) Within 30 days after completion of closure, the permittee shall file with the executive director a closure report on forms provided by the commission. The report shall be certified as accurate by the owner or operator and by the person who performed the closure operation (if other than the owner or operator). This report shall consist of a statement that the well was closed in accordance with the closure plan previously submitted and approved by the executive director. Where the actual closure differed from the plan previously submitted, a written statement shall be submitted specifying the differences between the previous plan and the actual closure.

(n) For salt cavern disposal wells, prior to sealing the cavern and plugging the well, the owner or operator shall complete any pre-closure monitoring of the cavern and its contents required by rule or permit.

(o) For salt cavern disposal wells, the cavern shall be closed according to Section 331.170 of this title (relating to Cavern Closure).

(p) The obligation to implement the closure plan survives the termination of a permit or the cessation of injection activities. The requirement to maintain and implement an approved plan is directly enforceable regardless of whether the closure plan requirement is a condition of the permit.

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§331.47. Pond Lining.

All holding ponds, emergency overflow ponds, emergency storage ponds, or other impoundments associated with, or part of the surface facilities associated with, underground injection wells shall be lined with clay or an artificial liner as approved by the executive director and as required by permit, and, shall in

addition, conform to any applicable requirements of Chapter 335 of this title (relating to Industrial Solid Waste and Municipal Hazardous Waste).

§331.48. Waiver of Requirements (for Class III and Class V Wells Only).

(a) When injection does not occur into, through or above an underground source of drinking water, the commission by permit may authorize a well with less stringent requirements than those required in this chapter to the extent that the less stringent requirements will not result in an increased likelihood of movement of fluid that may pollute USDWs, and fresh or surface water.

(b) When injection occurs and a cone of depression centered at the well or well field is maintained for the injection zone, the commission by permit may authorize a well with less stringent requirements for operation, monitoring, and reporting than those required in this chapter to the extent that the less stringent requirements will not result in an increased likelihood of movement of fluid that may pollute USDWs, and fresh or surface water.

(c) When requirements are reduced under subsection (a) or (b) of this section, a technical summary will be prepared setting forth the basis for the action.